

Test for 'Panel data'

May 28, 2015

1. In a linear panel regression model $y_{it} = X'_{it}\beta + u_{it}$, errors follow a one-way random-effects specification with individual effects only, i.e. $u_{it} = \mu_i + \nu_{it}$. Unfortunately, your software does not offer a RE estimator, although it offers OLS and also a facility for matrix operations. Fortunately, somebody has whispered in your ear the values $\sigma_\nu^2 = E\nu_{it}^2$ and $\sigma_\mu^2 = E\mu_i^2$. [12 points]
 - (a) Show that $\sigma_\nu^{-2}\{\mathbf{I}_{NT} - T^{-1}(\mathbf{I}_N \otimes \mathbf{J}_T)\} + (T\sigma_\mu^2 + \sigma_\nu^2)^{-1}T^{-1}(\mathbf{I}_N \otimes \mathbf{J}_T)$ is the inverse of the covariance matrix of u in this model. Recall that \mathbf{J}_T is a $T \times T$ -matrix filled with ones;
 - (b) Describe how you would construct a random-effects estimator for your data and model;
 - (c) Why would you use the fixed-effects estimator here, if T were really large?

2. In order to make the right choice between a random-effects and a fixed-effects (one-way) specification, you want to apply a statistical hypothesis test. Now assume that both estimates are available. Assume the coefficient vector β has dimension k . [11 points]

(a) You estimate the model via RE and via FE, and you find that you are to calculate a statistic of the form

$$m = q'(\text{var}\hat{\beta}_{FE} - \text{var}\hat{\beta}_{RE})^{-1}q.$$

What is the q in this statistic? What is the name of this test? What is the distribution of m under its null hypothesis?

(b) Suppose the test rejects its null. Which of the two specifications would you use then?

3. Using data on 47 developing countries during 40 years, a researcher wishes to establish the reaction of development aid to economic growth. Because of the suspected endogeneity of economic growth (in the data, per capita GDP growth), he uses two instruments, rainfall and a commodity price index. Fixed individual and time effects are used, and a two-stage estimator.[12 points]
- (a) Please try and give an interpretation of individual effects and of time effects in this model.
 - (b) What conditions should rainfall and the commodity price index fulfill in order to be valid instruments?
 - (c) What sign would you expect for the true coefficient of GDP growth in this model?